



MS4  
£4.00

# **GCE MARKING SCHEME**

**BIOLOGY (LEGACY)  
AS/Advanced**

**SUMMER 2009**

## **INTRODUCTION**

The marking schemes which follow were those used by WJEC for the Summer 2009 examination in GCE BIOLOGY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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## AS MODULE BI1

Question	Answers/Explanatory Notes	Marks Available
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1. (a)

Structure	Plant cell	Animal Cell
Centrioles	X	/
Mitochondria	/	/
Chloroplasts	/	X

(1 for each column)

[2]

(b) (i) Correct diagram showing double membrane with

Inner membrane folded.

[1]

Any 2 labels from matrix, crista, intermembrane space,

double membrane, stalked particles, DNA, ribosomes.

[2]

(ii) Aerobic respiration / ATP production (not: respiration)

[1]

(iii) Muscle cell / liver cell/sperm/pancreas/epithelial cell from small intestine/neurone/companion cell.

[1]

(iv) High requirement for energy for contraction/sperm movement / for chemical activity/high metabolic activity/active transport. (not: exercise)

[1]

**[Total 8 Marks]**

2. (a) A – interphase (not: resting phase).

B – mitosis (not: cell division).

C – prophase.

[3]

(b) (i) Metaphase - both chromosomes on equator, chromatids either side.

[1]

Anaphase – 4 V or U shaped, centromere pointing

towards centrioles.

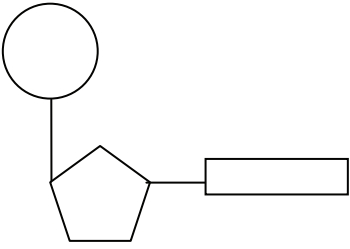
[1]

(ii) Nucleotide synthesis, replication of DNA, replication of

organelles, protein synthesis, growth, synthesis ATP.AVP. Any 2)

[2]

**[Total 7 marks]**

Question	Answers/Explanatory Notes	Marks Available
3. (a) (i)	 <p>Pentose shown as pentagon and labelled, sugar/ribose/deoxyribose [1]          Phosphate on C5 and labelled, phosphate/phosphoric acid [1]          Base on C1 and labelled, (nitrogenous) base/named base [1]</p>	
(ii)	<p>The pentose is ribose in RNA deoxyribose in DNA; [1]          (allow: clear description of extra oxygen e.g. sugar in DNA contains one less oxygen <u>atom</u> than sugar in RNA))          the base thymine is only found in DNA / uracil in RNA. [1]          (not: ref. helix/strands/uracil and thymine) Comparison needed</p>	
(b) (i)	(Alternating) sugar / pentose or deoxyribose and phosphate. [1]	
(ii)	<p>Adenine with thymine.</p> <p>Cytosine with guanine. [2]          (not: abbreviations) Correct spelling thymine/cytosine.</p>	
(iii)	Hydrogen. (not: H) [1]	
<b>[Total 9 marks]</b>		

Question	Answers/Explanatory Notes	Marks Available
4. (a) (i)	Fluid Mosaic.	[1]
(ii)	Head labelled hydrophilic <b>AND</b> tail labelled hydrophobic.	[1]
(b)	<p>Secondary structure is folding of polypeptide chain / ref. to <math>\alpha</math> helix or <math>\beta</math> pleated sheet;</p> <p>held by hydrogen bonds;</p> <p>tertiary is folding of <math>\alpha</math> helix or secondary structure / correct reference to specific 3D shape;</p> <p>held by bonds between R groups / name at least 2 from</p> <p>covalent, disulphide, ionic, salt bridges, hydrophobic, hydrogen, van der Waals.</p> <p>Any 4</p>	[4]
(c) (i)	<p>Charged groups will associate with (hydrophilic) heads</p> <p>of lipids / layer; / hydrophobic inside hydrophilic outside.</p> <p>Uncharged groups will associate with (hydrophobic) tails.</p>	[2]
(ii)	<p>Will associate with heads only / attach to outside or inside of the</p> <p>membrane / correct use of extrinsic or would be surface protein.</p> <p>(not: would not be in the membrane unqual.)</p>	[1]

**[Total 9 marks]**

Question	Answers/Explanatory Notes	Marks Available
5. (a)	<p><b>A.</b> Cell / plasma membrane      <b>B.</b> Cell wall</p> <p><b>C.</b> Cytoplasm      <b>D.</b> Tonoplast / vacuolar membrane</p> <p><b>E.</b> Vacuole      <b>F.</b> Plasmodesma(ta)</p> <p>(2 for all correct 1 if 1 mistake)</p>	
(b)	Diffusion; osmosis; active transport; facilitated diffusion. (Any 2) (not: apoplast/ symplast/ through F)	[2]
(c)	Cytoplasm / vacuole shrinks / gaps between wall and cytoplasm. (not: plasmolysis/cell shrinks)	[1]
(d) (i)	The difference between the free energy of water molecules in a system and the free energy of molecules in pure water / the tendency for water molecules to leave / move out of a system. (not: ref. to equation)	[1]
(ii)	Zero.	[1]
(iii)	P – 700 kPa. Q – 600 kPa.	[2]
(iv)	From Q to P/ into P (not: out of Q). (independent mark from (iii))	[1]
		<b>[Total 10 marks]</b>

Question	Answers/Explanatory Notes	Marks Available
6.		
(a) (i)	Showing, 1 O and 2 H s removed. Elimination of water, stated. Molecules joined by oxygen bridge.	[3]
(ii)	Maltose (not: disaccharide).	[1]
(iii)	Water.	[1]
(iv)	Condensation.	[1]
(b) (i)	Joining together sub units / monomers /repeating units/ residues (to make a larger molecule) (not: joining molecules into a chain/ specific example)	[1]
(ii)	Correct axes – iron sulphate concentrate on horizontal, both labelled and units given.  Suitable scale using at least half available space;  plots visible and clear line correct shape. (not: extrapolation/line of best fit)	[3]
(iii)	0.9mM (allow: between 0.7 and 0.9mM).	[1]
(iv)	$60 - 5.2 = 54.8 / 60 \times 100 = 91.3(\%)$ (allow: 91)  (2 for correct answer 1 for correct working but wrong answer.)	[2]
(v)	Inhibitor competes with substrate (to bind with active site);  inhibitor binds to/fits into active site;  with inhibitor bound substrate is unable to bind/less E-S complexes;  inhibitor same/complementary shape as substrate;  the greater the concentration of substrate the less inhibition / ra / owtte  (Any 3)	[3]
(vi)	(Add iron sulphate to toothpaste / mouthwash / sugary drinks.) to prevent formation of plaque / tooth decay.	[1]

**[Total 17 marks]**

Question	Answers/Explanatory Notes	Marks Available
7. (a)	A. DNA, mRNA, rRNA, tRNA for all 4.	[1]
	B. RNA polymerase explained.	[1]
	C. DNA is only found in / remains in the nucleus.	[1]
	D. Correct use of the term transcription.	[1]
	E. Description of unwinding / unzipping.	[1]
	F. (One strand) acts as template.	[1]
	G. RNA nucleotide sequence <u>directed by base pairing</u> .	[1]
	H. mRNA carries a complementary base sequence / copy of the instructions owtte.	[1]
	I. mRNA leaves nucleus (via pore) / enters cytoplasm/ moves to ribosomes.	[1]
	J. rRNA involved in attaching mRNA / adjusting phase / frame / translocation of ribosome.	[1]
	K. Correct use of the term translation.	[1]
	L. mRNA has codons / 3 bases to code for each amino acid in chain.	[1]
	M. tRNA has anticodon.	[1]
	N. Also carries a specific amino acid into ribosome.	[1]
	O. Holds amino acids in correct orientation for peptide bond to form.	[1]

**[Total 10 marks]**



Question	Answers/Explanatory Notes	Marks Available
7. (b)	<p>A. Transferring genes into organisms of different species or organisms/ involves cutting genes from chromosomes of one organism and splicing them into the genetic material of another. [1]</p> <p>B. Gene / DNA sequence must be identified. [1]</p> <p>C. Using gene probes / nucleotide / amino acid sequence. [1]</p> <p>D. Cut / isolate gene using restriction enzyme. [1]</p> <p>E. Or make from RNA using reverse transcriptase. [1]</p> <p>F. DNA polymerase to make a double strand. [1]</p> <p>G. Remove plasmids from suitable bacteria / use plasmids. [1]</p> <p>H. Cut plasmid using the same restriction enzyme / restriction enzyme recognises specific base sequences. [1]</p> <p>I. Reference to blunt / sticky ends / cDNA. [1]</p> <p>J. Those on extracted gene and cut plasmid will have complementary base pair. [1]</p> <p>K. Insert gene using ligase. [1]</p> <p>L. Plasmids reintroduced to bacterial cells. [1]</p> <p>M. Bacteria grown / incubated / allowed to multiply. [1]</p> <p>N. Marker genes / antibiotic resistant gene used to select bacteria carrying human gene. [1]</p> <p>O. Named human protein e.g. insulin. [1]</p>	
		<b>[Total 10 marks]</b>

## AS MODULE BI2

Question	Answers/Explanatory Notes	Marks Available
1. (a) (i)	movement of molecules from high to low concentration/down a concentration gradient;  passive / no ATP / energy involved;	[2]
(ii)	ATP / energy required;  against / up, a concentration gradient / low to high concentration;  ref. use of protein pumps in membrane. Any 2	[2]
(b)	facilitated diffusion / osmosis	[1]
<b>[Total marks 5]</b>		
2. (a) A	Name – palisade mesophyll/palisade cell;  Function – traps (sun) <u>light / energy</u> (for photosynthesis);	[2]
B	Name – vascular tissue or bundle / xylem/ phloem;  Function – transport water / sucrose / amino acids/products of photosynthesis.	[2]
(b) (i)	xerophytes	[1]
(ii)	three points on diagram, lines must point to a feature e.g.  thick epidermis;  <u>sunken</u> stomata;  hairs surrounding stomata;  <u>thick</u> cuticle;	[3 max]
(iii)	reduces (surface) transpiration or evaporation of water; (not: reduced transpiration)  shell of water vapour/moist air accumulates;  prevents movement of water vapour/moist air/retains water vapour;  prevents water passing through; (not: water/moisture) (allow: consequential error)	[3 max]
<b>[Total marks 11]</b>		

Question	Answers/Explanatory Notes	Marks Available																									
3.	(a)																										
	separate circulation for body and lungs;	[1]																									
	blood passes through heart twice <u>in one circuit</u> ;	[1]																									
	separates oxygenated and deoxygenated blood;																										
	maintains high blood pressure to tissues/body																										
	greater oxygenation of tissues; (not: quicker)																										
	lower pressure for pulmonary circulation/lungs; (Any 2 from 4)	[2]																									
	(b)																										
	vein;																										
	valve shown; (not: semi lunar valve)	[2]																									
	(c)																										
	<table><tr><th>Blood vessel</th><th>Carries blood from</th><th>Carries blood to</th><th>Oxygenated/ deoxygenated</th><th>Pressure high/low</th></tr><tr><td>Aorta</td><td>Left ventricle</td><td>Body / tissues</td><td>Oxygenated</td><td>high</td></tr><tr><td>Vena cava</td><td>Body / tissues</td><td>Right atrium</td><td>Deoxygenated</td><td>low</td></tr><tr><td>Pulmonary artery</td><td>Right ventricle</td><td>Lungs</td><td>Deoxygenated</td><td>high</td></tr><tr><td>Pulmonary vein</td><td>Lungs</td><td>Left atrium</td><td>Oxygenated</td><td>low</td></tr></table>	Blood vessel	Carries blood from	Carries blood to	Oxygenated/ deoxygenated	Pressure high/low	Aorta	Left ventricle	Body / tissues	Oxygenated	high	Vena cava	Body / tissues	Right atrium	Deoxygenated	low	Pulmonary artery	Right ventricle	Lungs	Deoxygenated	high	Pulmonary vein	Lungs	Left atrium	Oxygenated	low	
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Aorta	Left ventricle	Body / tissues	Oxygenated	high																							
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Pulmonary artery	Right ventricle	Lungs	Deoxygenated	high																							
Pulmonary vein	Lungs	Left atrium	Oxygenated	low																							
	1 mark per correct row.	[4]																									
	(d)																										
	site of exchange (of materials / substances / supplies metabolites)																										
	removes waste products;																										
	between blood/ capillary and tissues / cells / tissue fluid;																										
	tissue fluid formation;																										
	restrict/slow down blood flow to allow diffusion/exchange qual;																										
	reduces blood pressure/carries blood at low pressure;	[3]																									
		[Total 13 marks]																									

Question	Answers/Explanatory Notes	Marks Available
4. (a) (i)	time (for one cycle) is 0.7 sec;  $\frac{60}{0.7}$  85/86 <u>beats per minute</u> (allow: consequential error)	[3]
(ii)	hormones / endocrine system; (not: adrenaline)  nervous system	[2]
(b) (i)	B;	[1]
(ii)	C;	[1]
(iii)	D;	[1]
(iv)	A;	[1]
(c)	receives wave of excitation; (not: impulse)  delays contraction of ventricles;  passes on to Purkinje / Purkyne fibres / Bundle of His;  so ventricles contract from apex/bottom upwards;	[2 max]
		<b>[Total 11 marks]</b>

Question	Answers/Explanatory Notes	Marks Available
5. (a) (i)	<p>hunts / captures / kills another animal; and then eats/feeds on (part of) the animal;</p>	[2]
(ii)	<p>increase in paramecium through reproduction/birth rate exceeds death rate; predator introduction causes numbers to fall; suddenly / rapidly; predator numbers increase; until prey consumed; (not: die/die out) then predators have insufficient food; predator dies out/ decreases in number</p>	[4 max]
(iii)	<p>plateau/goes higher; takes longer to reach zero, must reach zero after day 5;</p>	[2 max]
(iv)	<p>numbers higher – no predator; reaches carrying capacity/stationary phase; birth rate = death rate ; exhaustion of food/lack of nutrients; accumulation of toxins / poisons; causes decline in numbers/die; takes longer to cause death of all organisms;</p>	[3 max]
		<b>[Total marks 11]</b>

Question	Answers/Explanatory Notes	Marks Available
6. (a) (i)	conversion / change of nitrogen gas: into nitrogen compound / nitrate / ammonium; (not: ammonia)	[2]
(ii)	growth; amino acid production; protein / enzyme (production); nucleic acid (formation).	[2 max]
(b) (i)	habitat / shelter/protection provides anaerobic conditions; supply of carbohydrate; and amino acids; (not: nutrients)	[2 max]
(ii)	difference – only one derives benefit / one harmed; similarity – two organisms of different species involved;	[2]
(c)	absorbs / combines with oxygen / maintains anaerobic conditions supplies oxygen to make nitrates;	[1]
		<b>[Total 9 marks]</b>

Question	Answers/Explanatory Notes	Marks Available
7. (a)	<p>A = removed/uptake from atmosphere by photosynthesis;</p> <p>B = by autotrophs / producers; (not:plants)</p> <p>C= forms carbohydrates / starch/glucose; (not:carbon compounds/sugars)</p> <p>D = incorporated into cellulose / protein;</p> <p>E = respiration occurs in plants releasing carbon dioxide;</p> <p>F = plants eaten by consumers / herbivores / animals;</p> <p>G = respiration occurs in animals releasing carbon dioxide;</p> <p>H = death and decay (of plants/ animal);</p> <p>I = ref to decomposers;</p> <p>J = bacteria and fungi;</p> <p>K = respiration occurs in decomposers releasing carbon dioxide;</p> <p>L = burning of fossil fuels;</p> <p>M = burning of forests releases carbon dioxide/ Deforestation decreases carbon dioxide uptake (not: deforestation unequal);</p> <p>N = ref to <u>carbon</u> in limestone;</p> <p>O = ref to <u>carbon</u> locked into fossil fuels;</p>	[10]

Question	Answers/Explanatory Notes	Marks Available
7. (b) (i)	<p>A = large surface area to volume ratio;</p> <p>B = moist surface / epithelium/membrane/covered in mucus;</p> <p>C = earthworm blood vessels under/close to skin surface;</p> <p>D = ref to blood pigments;</p> <p>E = thin / permeable epithelium/membrane;</p> <p>F = short diffusion pathway; (not: diffusion unequal)</p> <p>G = low metabolic rate;</p>	[5 max]
(ii)	<p>H = external intercostal muscles contract;</p> <p>I = ribs move up and out;</p> <p>J = contraction of diaphragm (muscles)/ diaphragm flattens; (not: diaphragm moves down)</p> <p>K = volume of thorax increases;</p> <p>L = decreases pressure in lungs/thorax;</p> <p>M = air pressure outside is higher;</p> <p>N = air <u>forced</u>/drawn into lungs; (not: moved)</p> <p>O = ref to role of pleural membranes;</p>	[5 max]
		<b>[Total 10 marks]</b>



## AS MODULE B14

Question	Answers/Explanatory Notes	Marks Available
1.	<i>Plasmodium</i>	[1]
	Antigenic	[1]
	Female/ <i>Anopheles</i>	[1]
	Vector (not: carrier)	[1]
	Endemic	[1]
	Liver <b>AND</b> red blood cells/ erythrocytes (in correct order)	[1]
<b>[Total 6 marks]</b>		
2. (a) (i)	red / pink	[1]
(ii)	<b>1</b> has a <u>thin</u> murein / peptidoglycan cell wall;	[1]
	<b>2</b> has an (additional) lipopolysaccharide / lipoprotein layer (outside) the cell wall;	[1]
(iii)	resistant to penicillin / lysozyme (spelling)(example needed, not:antibiotics)	[1]
(b)	bacillus (not: rod shaped)	[1]
(c)	causing abdominal pain/ vomiting/ diarrhoea (2 symptoms) (not: dehydration) produce (entero)toxins (which act on the small intestine)	[1] [1]
<b>[Total 7 marks]</b>		

Question	Answers/Explanatory Notes	Marks Available
3. (a)	(columnar) epithelium/epithelial tissue	[1]
(b)	goblet cell;	[1]
	secretes / synthesises mucus (not: protection unequal)	[1]
(c)	X Na/Glucose co-transport into cell; via facilitated diffusion / diffusion through protein carriers;	[1] [1]
	Y Active transport of Na out of cell; So lowering concentration inside cell/ maintaining the influx at X along with glucose;	[1] [1]
	Z Facilitated diffusion of glucose (into capillaries)	[1]
(d)	(Thickened epithelium) means greater distance for diffusion; less surface area / fewer transport proteins (not: less microvilli unequal); Less nutrient absorption; Respiration of body fat / proteins (leads to weight loss); [Any 3]	

**[Total 11 marks]**

Question	Answers/Explanatory Notes	Marks Available
4. (a)	axes correct - colorimeter readings vertical, axis at 0, -ve below, +ve above	[1]
	axes <b>both</b> labelled, including units, over half page	[1]
	scale correct and same on <b>both</b> axes	[1]
	all plots correct, no tolerance	[1]
(b)	As light intensity increases the reading increases / eq (or converse)	[1]
	Some ref to slowing of rate of increase at high LI / correct use of figs	[1]
(c)	Compensation (point)	[1]
(d)	Rate of respiration = Rate of photosynthesis	[1]
(e)	<u>Low Light Intensity</u> More CO <sub>2</sub> is produced / CO <sub>2</sub> is produced in respiration; More respiration (than PS); <u>High Light Intensity</u> Less CO <sub>2</sub> is present / CO <sub>2</sub> is used up in PS; More PS (than respiration); Any correct use of data; CO <sub>2</sub> or Temp are limiting factors at high LI; Any 4 points	[4]
		<b>[Total 12 marks]</b>

Question	Answers/Explanatory Notes	Marks Available
5. (a)	A sequence of dilutions; 10 fold or 100 fold Any correct description / diagram of how this is carried out eg 9+1 Any 2	[2]
(b)	a single living bacterium will reproduce/divide (asexually) to form a visible colony; colonies can then be counted to give an initial number of living bacteria. Any 2	[2]
(c)	Glucose is a monosaccharide;  (and so) can be used instantly for respiration/directly into glycolysis;  Lactose is a disaccharide;  And so needs hydrolysis into monosaccharides / eq;  Which requires synthesis of lactase;  Any 3	[3]
(d)	At start rapid increase in population;  as there is plenty of glucose;  Levels off when glucose runs out;  then synthesis of enzymes / lactase to hydrolyse lactose;  Rapid rise when lactose is hydrolysed;  To glucose and galactose;  Then levels off / stationary phase;  Correct use of figures;  Any 4	[4]
		<b>[Total 11 marks]</b>

6.

	<i>Oxidative phosphorylation</i>	<i>Cyclic photophosphorylation</i>	<i>Non cyclic photophosphorylation</i>
<i>Requires light</i>	NO	YES	YES
<i>Requires oxygen</i>	YES	NO	NO
<i>Produces oxygen</i>	NO	NO	YES
<i>Number of proton pumps involved</i>	3	1	1
<i>Source of Electrons</i>	Red NAD or Red FAD	PS I	Water / PSII (not: chlorophyll)
<i>Final electron acceptor</i>	Oxygen	PS I	NADP /NADPH <sup>+</sup>

(allow: ticks and blanks for first three points)

[1 mark per row ]

[6]

Question	Answers/Explanatory Notes	Marks Available
7. (a)	Docking protein / CP120 and Transmembrane glycoprotein/ GP41	[1]
	because they would both be recognised as foreign (by the immune system) or act as/recognised as antigens	[1]
(b)	There are different strains / antigenic types of HIV,	[1]
	and the virus constantly mutates	[1]
(c)	Flu	[1]
(d)	Lymphocytes recognize/detect Ag / foreign protein / carbohydrate as being foreign/non-self; Cloning/division of Lymphocytes (with matching receptors); Memory cells produced; Recognise same Ag if challenged with it subsequently (not: disease); Very rapid / decreased latent phase and increased immune response; A secondary response; Any 4 points in correct context	[4]
(e)	Use of preformed/monoclonal antibodies/ tetanus antitoxin; passive artificial immunity; Antibodies neutralise toxins / Ag (not: destroy); So reducing symptoms / increasing recovery rates Giving time for antibiotics/ immune system to destroy pathogen. Any 3	[3]
	(alternative answer: use antibiotics (1); prevent cell wall synthesis(1); prevent protein synthesis.)	

**[Total 12 marks]**

Question	Answers/Explanatory Notes	Marks Available
8. (a)	<p>A. Occurs in cytoplasm of (all cells) / Initial stage in the breakdown of glucose;</p> <p>B. Glucose is phosphorylated using 2 ATP</p> <p>C. Becoming hexose di phosphate</p> <p>D. This is split into 2 x triose phosphate</p> <p>E. TP is converted to Pyruvate</p> <p>F. Correct action of dehydrogenase</p> <p>G. Producing <b>2</b> x reduced NAD</p> <p>H. Explanation of net gain (4-2 used initially)</p> <p>I. <b>2</b> x ATP overall</p> <p>J. <b>2</b> x Pyruvate</p> <p>(8 max.)</p> <p><b>Anaerobic conditions <u>yeast</u></b></p> <p>K. Pyruvate is converted to acetaldehyde / ethanal</p> <p>L. With the production of carbon dioxide</p> <p>M. Acetaldehyde / ethanal is reduced to ethanol using the reduced NAD</p> <p><b>Anaerobic conditions <u>animal cell</u></b></p> <p>N. Pyruvate is reduced to lactate using the reduced NAD</p> <p>O. Regeneration of the oxidised NAD (animal or yeast)</p>	10 max (out of 15)

Max **7 marks total** may be awarded from suitable well labelled / annotated diagrams for any of the sections. Any text to be marked first.

Question	Answers/Explanatory Notes	Marks Available
8. (b)	<p>A. Antibiotics (in low concentration) inhibit the growth of microorganisms / bacteria <b>or</b> Antibiotics are substances produced by micro-organisms which affect the growth of/kills other microorganisms.</p> <p>B. Correct ref to bacteriostatic and bactericidal (both correct)</p> <p>C. Effective against a limited range called narrow spectrum and effective against a wide range of pathogenic bacteria called broad spectrum (both correct)</p> <p>D. Eg of a named antibiotic</p> <p>E. Widespread use/overuse of antibiotics has led to resistant bacteria / bacteria which cannot be killed by antibiotics</p> <p>F. Named eg MRSA / TB / VRSA / Pseudomonas/C. difficile</p> <p>G. Resistance due to (random) mutation in a population</p> <p>H. Confers a selective advantage in the presence of antibiotic or described</p> <p>I. Useful gene passes to offspring</p> <p>J. During conjugation/passes between bacteria via plasmids</p> <p>K. Overuse of antibiotics in farming</p> <p>L. Addition to feed / prophylactic use</p> <p>M. To promote growth</p> <p>N. People not taking the full course of prescription antibiotics leads to resistant bacteria surviving</p> <p>O. Prescribed for minor infections / no use against viral infections</p>	

**[10 out of the 15 marks available]**



## AS MODULE BI5

Question	Answers/Explanatory Notes	Marks Available
1. (a) (i)	A Hypothalamus	[1]
	B Medulla oblongata	[1]
	C Cerebellum	[1]
	D Cerebral hemispheres/ cerebrum/cerebral cortex (not: cortex)	[1]

(ii) 4 marks on diagram to correct areas

(b)

	receiving	amplifying	transducing
Malleus, incus, stapes	X	✓	X
Oval window	X	✓	X
Sensory hairs	X	X	✓
pinna	✓	X	X

1 mark per column

**[Total 11 marks]**

Question	Answers/Explanatory Notes	Marks Available
2. (a)	Pollination – transfer of pollen (from anther) to stigma	[1]
	Fertilisation – <u>fusion</u> of (male and female) gametes (not: meeting)	[1]
	Seed, product of (fertilised)/develops from ovule	[1]
	Fruit, product of (fertilised) ovary (not: ref. ovary wall) ( alternative: seed contains embryo and provides food store, Fruit contains seeds and provides protection/dispersal)	[1]
(b) (i)	Rises to peak at day of ovulation then drops	[1]
(ii)	(anterior) pituitary (not: posterior pituitary)	[1]
(iii)	Inhibits production of FSH;  Stimulates production LH;  Repair lining of uterus/endometrium (not: ref uterus wall); Accept ref. development glandular tissue in mammary glands; (not: ref. secondary sexual characteristics)	[3 max]
(iv)	Human chorionic gonadotropin (allow: HCG)	[1]
(v)	Placenta;	[1]
(vi)	Prolactin;	[1]

Question	Answers/Explanatory Notes	Marks Available
3. (a) (i)	<p>A = Cortex</p> <p>B = Medulla</p> <p>C = Pelvis</p> <p>D = Ureter –correct spelling</p> <p>E = Bladder</p> <p>F = Urethra –correct spelling</p>	[2 labels for 1 mark]
(ii)	position nephron on diagram, with only loop of Henle in medulla	[1]
(b) (i)	<p>efferent vessel narrower than afferent; (not: bigger/smaller)</p> <p>build up of pressure (in blood vessels)/hydrostatic greater than osmotic pressure;</p> <p>pores between endothelial cells/cells in capillary walls (not: holes unequal) ;</p> <p>pores in basement membrane (not: holes unequal/ SPM/basilar);</p> <p>filtration slits podocytes;</p> <p>allow small mols through but not large mols or cells (comparison required);</p>	[3 max]
(ii)	<p>Microvilli;</p> <p><u>large number</u> mitochondria;</p> <p>basal folds in membrane or description;</p> <p>acc. ref to co-transport proteins/carrier proteins/pumps;</p> <p>(not: ref. short diffusion pathway)</p>	[3 max]
(c) (i)	<p>form ammonia (which is highly soluble);</p> <p>toxic; (allow: poisonous, not: harmful)</p> <p>alkaline / change pH of tissues.</p>	[1 max]
(ii)	Increase blood pressure / dehydrate/affect WP blood/ref osmoregulation (not: water loss)	[1]

Question	Answers/Explanatory Notes	Marks Available
4. (a)	Characteristics controlled by pairs of factors/alleles; Only one factor in the gametes;	[2]
(b) (i)	Expresses itself in both the homozygous and heterozygous condition; (allow: always expresses/shown in phenotype)	[1]
(ii)	sex linkage	[1]
(c)	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A4</p> <p><math>X^nY</math></p> <p><math>X^n \quad Y</math></p> <p><math>X^nX^n</math></p> <p>female colour blind 1</p> </div> <div style="text-align: center;"> <p>B3</p> <p><math>X^nX^N</math></p> <p><math>X^n \quad X^N</math></p> <p><math>X^nX^N</math></p> <p>female normal (carrier) 1</p> </div> <div style="text-align: center;"> <p><math>X^nY</math></p> <p>male colour blind 1</p> </div> <div style="text-align: center;"> <p><math>X^NY</math></p> <p>male normal 1</p> </div> </div>	<div style="display: flex; justify-content: space-around;"> <div>[1]</div> <div>[1]</div> <div>[1]</div> <div>[1]</div> </div>
(ii)	$X^nX^N$ (not: multiple answers)	[1]
(c)	<p>Allow following alternative if not sex linked:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A4</p> <p><math>XnYn</math></p> <p><math>Xn \quad Yn</math></p> <p><math>XnXN</math></p> <p>Female normal 1</p> </div> <div style="text-align: center;"> <p>B3</p> <p><math>XXNn</math></p> <p><math>XXN \quad Xn</math></p> <p><math>XnXn</math></p> <p>female c. blind 1</p> </div> <div style="text-align: center;"> <p><math>XYn</math></p> <p>male normal 1</p> </div> <div style="text-align: center;"> <p><math>XnYn</math></p> <p>male c. blind 1</p> </div> </div>	<div style="display: flex; justify-content: space-around;"> <div>[1]</div> <div>[1]</div> <div>[1]</div> <div>[1]</div> </div>
(ii)	$XXNn$	[1]
(d)	People with haemophilia (without medical intervention) die before breeding age/choose not to have children/females die in utero. (not: too ill to have children)	[1]

Question	Answers/Explanatory Notes	Marks Available
5. (a)	<p>A. Fibre, myofibril; (not: fibril)</p> <p>B. Sarcolemma, sarcoplasm, large numbers mitochondria, SR, T tubules, multinucleate, 3 from; (not: cytoplasm)</p> <p>C. sarcomere qual; (i.e. Z – Z) (not: sacromere)</p> <p>D. thin actin and thick myosin;</p> <p>E. Ref. Z line correct position;</p> <p>F. Ref. A band. Myosin (and overlapping actin);</p> <p>G. Ref. I band actin only;</p> <p>H. Ref H zone</p> <p>I. Ref M line</p> <p>J. Sliding filaments</p> <p>K. evidence for sliding – I band shortens, H zone narrower, A band stays same;</p> <p>L. cross bridges;</p> <p>M. myosin heads bind to actin</p> <p>N. details ratchet mechanism/ description – attach, contract, release, reattach, repeat;</p> <p>O. function of ATP, breaks bonds between actin and myosin;</p> <p>P. Role of calcium. Change shape of tropomyosin exposing binding Site, attaches to troponin.</p> <p>Q. Ref. sarcoplasmic reticulum and calcium secretion</p> <p>R. Ref. calcium and depolarisation</p>	<p>[4 max]</p> <p>[6 max]</p>

Question	Answers/Explanatory Notes	Marks Available
5. (b)	<p><i>Darwin</i></p> <p>A. Darwin recognised that species/organisms did change (not: ref mutation);</p> <p>B. Put forward a theory/ Natural selection to explain it;</p> <p>C. Overproduction;</p> <p>D. Numbers remain constant;</p> <p>E. Therefore high mortality rate;</p> <p>F. Variation (within a species);</p> <p>G. Individuals with a beneficial variation survive / survival of fittest qual;</p> <p>H. Breed (together)/reproduce;</p> <p>I. Offspring (likely to) inherit beneficial characteristic;</p> <p>J. Repeats generation after generation;</p> <p>K. Darwin suggested that the finches on the Galapagos islands had a common ancestor;</p> <p>L. Details of finches / beak adaptations/tortoises size or neck;</p> <p>M. Recognised adaptive radiation;</p> <p>N. Fossil evidence;</p> <p>O. (Living) intermediate forms;</p> <p>P. Similarities in DNA between related species or example;</p> <p>Q+R. AVP e.g. Similarities in proteins / biochemical similarities/ ref. pentadactyl limb/MRSA/warfarin resistance/peppered moth/parallel evolution; (Any 2, not: ref speciation)</p> <p>[Any 10]</p>	

Question	Answers/Explanatory Notes	Marks Available
6. (a) (i)	Fucus (correct spelling)	[1]
(ii)	Nuclear membrane / nucleus; linear DNA; histones / protein associated with DNA in chromosomes; large/70s ribosomes; mitochondria /ER/Golgi/chloroplasts/ membrane bound organelles; cellulose/chitin cell  wall; cilia / flagella 9 + 2 structure/centrioles; (not: membrane bound DNA)	[2 max]
(b) (i)	4 cells from meiosis, each undergo 4 mitotic divisions = 16;  Answer 64;	[2]
(ii)	Meiosis variation;  Meiosis halves the number of chromosomes/makes haploid cells  (allowing sexual reproduction)/number restored when gametes join;	[2]
	Mitosis increase numbers/chance of fertilisation; (not: ref clones/amount)	[1]
(c) (i)	shown on diagram clockwise: diploid, haploid, diploid (2n/n/2n= 2 marks max)	[3]
(ii)	mitosis (exact spelling);	[1]
(d) (i)	Buoyancy, store gases	[1]
(ii)	Daytime rate of photosynthesis exceeds respiration  Carbon dioxide levels fall, oxygen levels rise;  Could be a certain light intensity when no change /  rate of P = rate of R/compensation point;  Night time (no light) no photosynthesis but respiration takes place;  Carbon dioxide levels rise, oxygen levels fall; [4 max]	[4]

Question	Answers/Explanatory Notes	Marks Available
(e)	<p>Lose water (when covered by salt water) because of <u>osmosis</u>;</p> <p>(Soluble) mannitol lowers water potential (in cells) (not: starch);</p> <p>No/lowers water potential gradient so do not lose/less water;</p>	[2 max]
(f)	<p>carbonic anhydrase causes water + carbon dioxide to combine</p> <p>to produce carbonic acid;</p> <p>Dissociates/breaks down to produce hydrogen carbonate (and protons);</p> <p>Increases hydrogen carbonate levels;</p>	[2 max]



Question	Answers/Explanatory Notes	Marks Available
7. (a)	<p>Primary form, sequence of amino acids; (not: chain of ..)</p> <p>Tertiary structure, three dimensional folding/folding secondary structure; (not: folding unequal)</p> <p>Endopeptidase, enzyme which hydrolyses / breaks a polypeptide /peptide bond/ protein in the middle of chain or into shorter chains (not; within chains);</p>	[3]
(b) (i)	<p>calcium channels open/membrane becomes permeable to calcium;</p> <p>Calcium moves into cytoplasm/synaptic knob;</p> <p>Synaptic vesicles move towards presynaptic membrane;</p> <p>Fuse with membrane;</p> <p>Transmitter substance/acetyl choline released into synaptic cleft; (not: vesicles into cleft)</p> <p>Exocytosis (allow:ecf if ref to vesicles);</p> <p>Diffuses across cleft/gap;</p> <p>Binds to receptors on post synaptic membrane/sarcolemma;</p> <p>Sodium ions in or depolarisation/setting up action potential</p>	[5 max]
(ii)	<p>no exocytosis / no release of transmitter substance into cleft;</p> <p>sodium ions do not move across postsynaptic membrane/sarcolemma,</p> <p>action potential not generated in post synaptic membrane/sarcolemma;</p>	[2]
(iii)	<p>toxin/poison destroyed/broken down/attacked by antibodies</p> <p>new neuro muscular junctions made / new synapses;</p> <p>any other valid point e.g. more vesicles produced than could be affected/reverts back to primary structure;</p>	[1 max]
(c)	<p>prevents action potential/depolarisation/prevents threshold being reached;</p> <p>stops influx of sodium ions/blocks sodium channels;</p> <p>(not: ref. synapses)</p>	[1] [1]



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